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U.S. ARMY

HUMAN FACTORS ENGINEERING

BIBLIOGRAPHIC SERIES

VOLUME 2

1960-1964 LITERATURE

Prepared by

THE PROJECT STAFF

DEPARTMENT OF DEFENSE

HUMAN FACTORS ENGINEERING INFORMATION ANALYSIS CENTER

Institute for Psychological Research Tufts University

October 1966

HUMAN ENGINEERING LABORATORIES



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October 1966

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Behavioral Sciences Laboratory Wright Air Development Center U. S. Air Force

U. S. ARMY HUMAN ENGINEERING LABORATORIES Aberdeen Proving Ground, Md.

The Department of the Army was assigned responsibility, effective 1 October 1965, for the development and maintenance of a Human Factors Engineering Information Analysis Center in accordance with the provisions of the Department of Defense Scientific and Technical Information program (DoD Instruction 5100.45). At present the Information Analysis Center is located at Tufts University under the technical guidance of the U. S. Army Human Engineering Laboratories.

The Office of Naval Research initiated the Tufts University effort over ten years ago. This volume, the one preceding it, and a subsequent volume, covering the human factors engineering literature from 1940 through 1965, although published by the U. S. Army Human Engineering Laboratories, is a result of the Office of Naval Research support and direction of this program during its formative years.

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Introduction

This document is the second in a series of bibliographies covering the human factors engineering literature. The first volume, HEL BIB VOL I, covered the 1940 through 1959 literature. The present bibliography contains material, for the most, from the time period 1960 through 1964. A third bibliography dealing with the 1965 literature will be published soon.

As in the past the project staff was influenced by several considerations in the selection of references for inclusion in the bibliography. First, there was an attempt to select those references which reflected the broad spectrum of revealed interests of human factors personnel. Second, the documents had to be available to the project staff for examination prior to coding and abstracting. If the document was not among the acquisitions of the project, it was not included in the bibliography.

Because of the tremendous volume of literature published during this period, the project staff was not able to acquire every document of relevance. The present volume should, however, provide a useful compilation of references to the human factors engineering literature which reflect the cumulative (through 1964) acquisitions of HEIAS.

This and future volumes will be published in punched loose leaf page format. This will permit additions of new material and modifications of old. Additions will be in the form of new acquisitions. Modifications will be primarily in the form of changes to the index and the resulting changes in the coding of the accessions involved. At some later date it is planned to publish a complete set of those pages that have been or will have been modified. Also at some later date an author index will be published. It is suggested that the user place the present volume in a notebook (or notebooks) or whatever form he finds convenient for use and future modifications.

General

The user should examine the index (Part I) thoroughly before attempting to locate references on a specific topic. Familiarization with the terms is essential if effective retrieval is to be realized. After examining its content, the user should be able to enter the index with the terms which are descriptive of, or synonymous with his query. Documents have been coded only to those terms or descriptors which are underlined. Having noted the terms of interest he should then go to Part II (Facsimile of Subject Matter File) and under the appropriate terms find the accession numbers of those documents which have been coded to that term. Noting these numbers he can then go to Part III (Citations and Abstracts) to find the actual references.

Index Changes

There have been some slight modifications in the index published in the first volume of this series. These changes are reflected in the present index. Some of the modifications are described below:

	(added)	Airport facilities
Ambient Noise level of background, general	(changed to)	Ambient Noise level office, home, and general background
rockets, missiles	(changed to)	rockets, missiles, and launch facilities

Anthropometric Measures body density centers of gravity	(changed to)	Anthropometric Measures body density and centers of gravity
Auditory reaction time	(changed to)	Auditory reaction timesee Reaction Time and Refractory Period
Auditory skills sonar listening	(changed to)	Auditory skills sonar listeningsee Monitoring, above
Automatic checkout systems	(changed to)	Automatic checkout systemssee Maintenance (systems)
<u>Clothing</u> <u>belting</u>	(changed to)	Clothing belts and fasteners
Ship and submarine controls	(changed to)	Controls ship and submarine controls see Ship and Submarine
vehicle controls	(changed to)	vehicle controlssee Vehicle
<u>Displays</u> <u>size</u>	(changed to)	Displays size and shape
Escape from aircraft	(changed to)	Escape from aircraft and spacecraft
submarines	(changed to)	submarinessee Ship and Submarine
Groups effectiveness problem solving productivity	(changed to)	<u>Groups</u> <u>performance</u>
<u>size</u> structure	(changed to)	size and structure

Individual Factors Affecting Performance attention set	(changed to)	Individual Factors Affecting Performance set and attention
Life Jackets	(changed to)	Life Jacketssee Sea (rescue)
Lighting Systems outdoors airfields	(changed to)	Lighting Systems outdoors airport
	(added)	Machine Recognition
Motion, Effects of amplitude and frequency oscillatory rotation	(changed to)	Motion, Effects of rotation and oscillation (includes amplitude and frequency)
	(added)	sub-category of <u>general</u> to <u>Optical Aids</u>
Overlays	(changed to)	Overlayssee Radar and other CRT Displays
Panel and Console Design ships and submarines	(changed to)	Panel and Console Design ships and submarinessee Ship and Submarine (controls, displays, and instrument panel design)
vehicles	(changed to)	vehiclessee Vehicle (controls, displays, and instrument panel design)
Physiological Capacities	(changed to)	Physiological Capacities and Indices
	(added)	electroencephalogram
Physiological Equipment and Methods first five sub-categories	(changed to)	Physiological Equipment and Methods electrophysiological techniques
Printed Material, Legibility, and Readability general references readability	(removed)	

Sea craft, design of	(changed	to)	Sea craft, design ofsee Ship and Submarine
Sensory facilitation and inhibition of reception	(changed	to)	<pre>Sensory interaction (i.e., effects of stimulation in one modality on perception in another; includes facilitation and inhibition)</pre>
Ship lighting systems exterior	(changed	to)	Ship and Submarine controls, displays, and instrument panel design escape systems general habitability lighting systems
Space Flight Systems control systems	(changed	to)	Space Flight Systems control and display systems
Space Travel maneuvers	(changed	to)	Space Travel maneuvers and performance
Speech communication systems ship	(changed	to)	Speech communication systems ship and submarine
Submarine controls crewssee Groups displays escape systems general references habitability	(changed	to)	Submarinesee Ship and Submarine
	(omitted	from	1940-59 product) Underlining of television under <u>Training Aids</u> and <u>Devices</u>
Underwater environmental effects oxygen requirements pressure requirements	(changed	to)	Underwater oxygen and pressure requirements

	(added)	Vehicle controls, displays, and instrument panel design
Visual acuity colored illumination general references types of dynamic static	(changed to)	Visual acuity dynamic general illumination
Visual reaction time	(changed to)	Visual reaction timesee Reaction Time and Refractory Period
Windshields evaluation of	(changed to)	Windshieldssee also Aircraft (design); Vehicle (design)
Work Place Design illumination command centers	(changed to)	Work Place Design illumination command centerssee other facilities, below
factory and office home	(changed to)	factory, office, and home
ship and submarine	(changed to)	ship and submarinesee Ship and Submarine
vehicle	(changed to)	vehiclesee Vehicle

The Index and Its Use

The accessions are only coded to those terms which are underlined and in the cases of subheading, are coded to the lowest subcategory (i.e., to the secondary or tertiary heading, if there is one). For example, if the reader will note the category Aging, Effects of, he will find a number of secondary categories, such as vision; motor performance; etc. No references have been coded to Aging, Effects of, as such, but only to the secondary headings. In the case of Radar and other CRT Displays the reader will note the secondary heading screen and under this, various tertiary headings, such as size and shape. Relevant documents, for example those dealing with the shape of radar screens or scope faces, have been coded to the lowest subcategory, in this case size and shape. No references will have been coded to screen alone.

The index can, of course, be used as a hierarchical system or a coordinate index. For example, if a user were interested in articles dealing with drugs and their effects, he would examine the references listed in the category <u>Drugs</u>. Similarly, if he were interested in articles dealing with man's tolerance to acceleration, he would go to the category <u>Motion</u>, <u>Effects of/acceleration and deceleration/tolerance</u>. However, if he were interested in the effects of drugs on man's tolerance to acceleration forces, rather than go through all the references in the above mentioned categories, the reader should note only those accession numbers common to both categories. The loose leaf notebook form should facilitate this type of matching.

The reader is advised to look through the various general categories in making a search. These categories contain not only

references of a general nature, books, bibliographies, etc., but in some cases miscellaneous articles which could not be readily coded elsewhere. Occasionally, the reader will note a secondary heading 'other'. These categories contain references to equipment, methods, topics, etc., not specifically listed under the main heading.

An index of this nature develops through use. All relevant terms and descriptors cannot be anticipated in its initial development and are often incorporated only after the index has been in use for some time. Therefore, if the user cannot find terms specifically descriptive of his problem he should attempt to find synonymous terms. As mentioned previously, the user should examine the whole index thoroughly before attempting to locate specific topics.

Facsimile of Subject Matter File

Part II contains those categories to which documents have been coded along with the accession numbers of the documents. In essence, it represents the index stripped to the bare essentials, i.e., minus all cross headings and notes. The user will note that there are several categories with only a few or no references coded to them. These categories were left in the index because it is known that in the 1960-1965 bibliographies, there will be a number of references coded to them.

Citations and Abstracts

Part III contains the actual citations and abstracts listed in numerical order by accession number. This section was compiled by filming the actual 3x5 citation and abstract cards from the files of HEIAS. In some cases the reference material was on a 5x8 card. This

presented layout problems and in an attempt to conserve as much space as possible some cards had to be placed sideways for filming. While we realize this presents somewhat of an inconvenience for the reader, we feel the conservation of space was worth it.

The format of the citations is generally in keeping with the recommendations of the Publication Manual of the American Psychological Association. In some instances, however, variation in the amount and type of information in the original document has introduced some variation in the final citation. The content of the citation tries to maximize the amount of information to assist the user in acquiring a copy of the document.

The abstracts for the most part are descriptive only and do not contain results. However, in the future results will be included. It was simply too great a task to go back and re-abstract documents for this bibliography. The letter codes found at the end of the abstract, the T, I, G, and R designations indicate that the document contains: T-tables, I-illustrations, G-graphs, and R-references (e.g., R-7 means that 7 references were cited). A list of abbrevations used in the abstracts is given on the next page.

The documents cited are not available from Tufts University, but are held in repository at HEIAS and may be examined on the project's premises.

KEY TO ABBREVIATIONS

	1.		
a.c.	alternating current	9	acceleration of normal pull of gravity
AD	average deviation	G	gravitational force acting upon an object
AFGCT	Armed Forces General Classification Test	GCA	Ground Control Approach
AGCT	Army General Classification Test	GSR	galvanic skin response
AL	adaptation level		
amp.	ampere	Hg hr.	mercury hour
ANIP	Army-Navy Instrument Program		liou!
ANOVA	analysis of variance	ī	intensity
AP	action potentials	I BM	international Business Machine
AR	acoustic reflex	i.e.	that is
AVID	Advanced Visual Information Display	ILS	Instrument Landing System
		in.	inch
bit	unit of information	10	Intelligence Quotient
BMR	basal metabolic rate		
		j.n.d.	just noticeable difference
C	centigrade		* The second second second
ca	about or approximately	kc	kilocycle
cc	cubic centimeter	kg	kilogram
ccc	Combat Control Center	KR	knowledge of results
cff	critical flicker frequency		Monteage of Federal
CIC	Combat Information Center	L	lambert
clo	measure of protective value of fabrics	LL	loudness level
cm	centimeter	16	pound
CNS	central nervous system	10	podita
CO	carbon monoxide	m	meter
	carbon dioxide	M	
CO ₂			mean
cpm	cycles per minute	Ма	milliampere
cps	cycles per second	Mc	megacycle
CR	critical ratio	Mdn	median
CRT	cathode ray tube	mg	milligram
cu ft	cubic foot	m i	mile
	1.00	min.	minute
db	decibel	mL	millilambert
d.c.	direct current	mm	millimeter
df	degrees of freedom	MOS	Military Occupational Specialty
DL	difference limen	mph	miles per hour
		msec	millisecond
E, Es.	experimenter, experimenters	m	millimicron
EEG	electroencephalogram	µsec.	microsecond
e.g.	for example		
EKG or ECG	electrocardiogram	N	number of
EMG	electromyogram		
ERG	electroretinogram	0	degree
et al	and others	0, Os.	observer, observers
etc.	and so forth	02	oxygen
Exp.	experiment	ocs	Officers' Candidates School
		OR	Operations Research
f	frequency		
F	fahrenheit, F-ratio	Р	probability level
ft	foot	PB	phonetically balanced
ft-c	foot-candle	PERT	Program Evaluation and Review Technique
ft-L	foot-Lambert	PGR	psychogalvanic skin response
ft-lbs	foot-pounds	PI	photo interpretation
ft/sec	feet per second	PPI	Planned Position Indicator
The state of the s			

KEY TO ABBREVIATIONS (cont'd)

pps		pulses per second
psi		pounds square inch
PSS		Personnel Subsystem concept (USAF)
	PED	Personnel and Equipment Data file
	HE	verifying Human Engineering design Standards
	QQPRI	Qualitative and Quantitative Personnel Requirements Information
	PSTE	Personnel Subsystem Test and Evaluation
	TC	Training concepts
	TED	Training Equipment Development program
	TEPI	Training Equipment Planning Information
	TOTM	Technical Orders and Manuals
	TP	Training plans
r		roentgen, correlation coefficient
rad		absorbed dose of radiation
REM		Roentgen equivalent in man
RBE		relative biological effectiveness
ROT	C	Reserve Officers Training Corps
rpm		revolutions per minute
RT		reaction time
S, S	Ss	subject, subjects
SAGE	E	Semi Automatic Ground Environment
SD		standard deviation
SDT		signal detection theory
sec		second
S/N		signal-to-noise ratio
SPL		sound pressure level
S-R		stimulus-response
SUB	IC	Submarine Integrated Control
t		t-test
TTS		temporary threshold shift
٧S		versus

VTOL

SYMBOLS:

x ²	chi square
%	per cent
>	more than
<	less than
=	equal
ΔΙ	change in intensity
μ	micron
σ^2	variance

Vertical Takeoff and Landing Aircraft

A

```
Ability Testing--see Tests and Testing (proficiency)
Absolute Judgments--see Psychophysics; specific sensory categories
Absolute Pitch--see Audition (stimulus characteristics)
Acceleration and Deceleration--see Motion, Effects of
Acceptability of Equipment and Tasks--see Individual Factors Affecting Performance
Accessibility--see Maintenance (design for); Work Place Design (area requirements)
Accidents--see Safety
Acclimatization--see Environmental Conditions and Effects (tolerance, adaptation,
                 acclimatization); Physiological Capacities and Indices
Accommodation and Convergence--see Visual
Accuracy of Movement--see Motor Performance and Skills (speed and precision)
Acoustic
    design--see also Ambient Noise (reduction and control); Work Place Design (acoustics)
     engineering--see design, above
     measurement--see Ambient Noise (measurement)
     reflex--see Audition (aftereffects of stimulation)
     shielding--see Ambient Noise (reduction and control)
Action Potential--for data, see Physiological Capacities and Indices; for methods, see
                  Physiological Equipment and Methods
Activity Analysis--see Methods and Techniques for Study and Analysis of Tasks, Operations,
                   and Systems
Acuity
     auditory--see Audition (thresholds)
     sensory, other--see specific sensory categories
     visual--see Visual
Adaptation
     auditory--see Audition (aftereffects of stimulation)
     perceptual -- see Perception (general)
     theory--see Perception (theory)
     visual--see Visual (adaptation, pre-adaptation, and pre-exposure)
Adjustment, Method of--see Psychophysics (methods)
Aerial Observations--see Visual (search and detection)
Aerospace Medicine, general -- see Environmental Conditions and Effects (general); Space Travel
A-Frames--see Packs and Carriers
Afterimages--see Audition (aftereffects of stimulation); Visual (aftereffects, afterimages)
Aging, Effects of
     audition
     general
     motor performance
     vision
     work capacity
Aiding--see Tracking
Aiming--see Motor Performance and Skills
Airblast--see Environmental Conditions and Effects (windblast, airblast, windchill)
Airborne Equipment--see Aircraft (related equipment)
Air Conditioning--see Work Place Design (atmospheric control)
Aircraft
     accidents--see Safety
     collision--see Safety
     communication systems--see Speech (communication systems)
     controls--see Controls
     design--see also Helicopters; VTOL, STOL Aircraft
     escape from--see Escape from
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Aircraft -- (cont'd)
      general
      instrument panel arrangement--see Panel and Console Design
      landing and landing systems
      lighting, exterior
      lighting, interior--see Work Place Design (illumination)
      noise--see Ambient Noise (level)
      related equipment
      visibility and recognition--see Visual (search and detection)
 Air Crews--see Groups
 Airport (airfields)
     facilities--see also Air Traffic Control Systems
     lighting--see Lighting Systems (outdoors)
     noise--see Ambient Noise (level)
      runway design--see Aircraft (landing and landing systems)
Air Reconnaissance--see Visual (search and detection)
Air Sickness--see Motion, Effects of
Airspeed Indicators--see Displays (type)
Air Traffic Control Systems
     communication and information flow--see also Language Design; Speech (communication
     control problems
     equipment (displays, etc.)
     general
     layout and workplace design
     operator variables
     traffic flow
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Alphanumeric Displays--see Displays (type); Radar and other CRT Displays (types)
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Altitude Chamber--see Environmental Conditons and Effects (equipment and methods)
Altitude, Effects of--see Environmental Conditions and Effects
Ambient Noise
    accidents--see effects on performance, below
    composition--see measurement, below
    control--see reduction and control, below
    criteria for buildings--see Acoustic (design); reduction and control, below;
                            Work Place Design (acoustics)
    deafness--see hearing loss, below
    effects on performance (includes industrial efficiency)
    general
    hearing loss--see also Audition (aftereffects of stimulation)
    injury--see hearing loss, above
    level
         aircraft
         airport
         equipment, general
         industrial environments
         office, home, and general background
         rockets, missiles, and launch facilities
         ships and submarines
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Ambient Noise
    level (cont'd)
         vehicle (motor)
          weapons
    measurement (e.g., spectral analysis, critical band analysis)
     reduction and control -- see also Acoustic (design); Work Place Design (acoustics)
          acoustic shielding
          general
         hearing conservation program
          noise reducing devices and systems
          personal equipment (e.g., earplugs) -- see Auditory (devices)
          standards of tolerance and annoyance
     speech interference level--see Speech (masking)
     tolerable level--see reduction and control, above
Amplifiers--see Auditory (equipment)
Anchoring Effects--see Perception (general); Psychophysics
Anechoic Chambers--see Audition (equipment and methods)
Angle, Perception of -- see Visual (perception)
Ankle Dimensions--see Anthropometric Measures
Anomalies
     auditory--see Audition
     sensory, other--see specific sensory categories
     visual -- see Visual
Anoxia--see Environmental Conditions and Effects (oxygen requirements)
Anthropometric Measures
    arm and leg dimensions
    biomechanical analysis
     body density and centers of gravity
    body size and dimensions
    equipment and methods
    extent and flexibility of limb movement
    general
     hand and foot dimensions
    head dimensions
    locomotion
    muscular strength and endurance
     posture
    somatotyping
     space requirements--see also Work Place Design (area requirements)
Anti-g-Suits--see Clothing (high altitude and anti-g)
Anxiety--see Individual Factors Affecting Performance (emotion)
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Apparent Movement--see Visual (perception)
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Aptitude Testing--see Tests and Testing
Aqua Lung--see Underwater (breathing apparatus)
Arctic Climate Clothing--see Clothing (Arctic ensembles and cold weather)
Arm
     dimensions--see Anthropometric Measures
    movement--see Anthropometric Measures; Motor Performance and Skills
     strength--see Anthropometric Measures (muscular strength and endurance)
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Articulation Testing--see Communications Systems (techniques for evaluation); Speech
Artificial Intelligence (biosimulation)
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Aspiration, Level of--see Individual Factors Affecting Performance (motivation and morale)
Assignment of Functions to Men and Machines in Systems
Assignment of Personnel -- see Personnel
Atmosphere--see Environmental Conditions and Effects
Attention--see Individual Factors Affecting Performance (set and attention); Perception;
           Training (basic learning data); Vigilance and Monitoring
Attenuators--see Auditory (equipment)
Attitude Indicators -- see Displays (type)
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                      attitude toward equipment and tasks)
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Audiometry--see Audition (equipment and methods); Speech
Audio-Visual Aids--see Training Aids and Devices
Audio-Visual Interaction--see Sensory (interaction)
Audio-Visual Monitoring--see Vigilance and Monitoring (performance)
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Audition
     aftereffects of stimulation (e.g., acoustic reflex, fatigue, pitch shifts, time errors, etc.)
     aging--see Aging. Effects of; norms, below
     anomalies and individual differences
     auditory patterns and meaning (e.g., flutter discrimination, melodic and temporal)
     binaural vs. monaural
     equipment and methods (e.g., anechoic chambers, audiometric devices, communication
                             simulators, techniques of audiometry)
     general
     norms
     physiological mechanisms
     psychophysical scales (e.g., mel scale, sone scale)
     repetitive stimulation
    sound localization
    standards and specifications
    stimulus characteristics
         frequency and pitch
         intensity and loudness
         other (e.g., brightness, duration, timbre, vocality)
    stimulus mixtures (e.g., harmonics, beats, combination tones, modulations)
    thresholds
     training, nonverbal -- see Training (specific types)
Auditory
    acuity--see Audition (thresholds)
    adaptation--see Audition (aftereffects of stimulation)
    detection -- see skills, below
    devices
         ear defenders (e.g., plugs, pads, etc.)
         enhancement devices (e.g., hearing aids, guidance for blind, etc.)
    displays, nonverbal--for systems utilizing verbal communication, see Speech
                          (communication systems)
         flight guidance systems (flybar)
         intermittent warning and signaling devices (e.g., sirens, bells, radio range)
         multi-channel
         sonar and other underwater sound systems
         telegraphic systems
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.7

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Auditory (cont'd)
    equipment
          input devices (e.g., microphones, vibration pickups)
         output devices (e.g., earphones, loudspeakers)
          transmission devices (e.g., amplifiers, attenuators, frequency modulators.
                                scramblers)
     fatique--see Audition (aftereffects of stimulation)
     feedback--see signals, below
     flight guidance systems--see displays, above
     localization--see Audition (sound localization)
     masking--for speech masking, see Speech
     noise--see Ambient Noise
     numerousness--see signals, below
     patterns--see Audition
     reaction time--see Reaction Time and Refractory Period
     search--see skills, below
     signals
          channel capacity
         coding
          detection -- see skills, below
          feedback
          general characteristics
          to-noise ratio
     skills
          discrimination
          monitoring
          search and detection
          sonar listening--see monitoring, above
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          training--see Training (specific types)
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Aural Reading Devices -- see Auditory (devices)
Auto-Correlation Function--see Mathematical and Statistical Methods
Autoinstruction--see Programmed Instruction; Training Aids and Devices (teaching machines)
Autokinetic Effects--see Visual (perception)
Automatic
     checkout systems--see Maintenance (systems)
     control systems--see Controls
     learning devices--see Training Aids and Devices (teaching machines)
     maintenance--see Maintenance (systems)
Automation
Automobile Accidents--see Safety
Automobile Design--see Vehicle
Automobiles--see Vehicle
Aviation Medicine--see Environmental Conditions and Effects (general)
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Backlighting--see Instrument Lighting (rear)
Back Rests--see Seats and Seating (body supports)
Ballistic Vests--see Clothing (body armor)
Band Compression Speech--see Speech (distortion)
Barometric Pressure--see Environmental Conditions and Effects
Basic Training--see Training (specific types)
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Beacon Lights--see Warning and Signal Lights
 Bearing Information Aids--see Radar and other CRT Displays (range and bearing scales and aids)
 Beats--see Audition (stimulus mixtures)
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 Belts, Harnesses, and other Restraining Devices--see also Clothing (belts and fasteners)
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 Binocular Field--see Visual (field)
 Binoculars--see Optical Aids
 Biodynamics--see also Anthropometric Measures; Motor Performance and Skills
 Bioelectric Methods and Equipment--see Physiological Equipment and Methods
 Bio-instrumentation--see Physiological Equipment and Methods
 Bio-kinetic Analysis--see Anthropometric Measures; Motor Performance and Skills
 Biomechanical Analysis--see Anthropometric Measures; Motor Performance and Skills
Bionics
Biosimulation--see Artificial Intelligence
Bisectioning Movements--see Motor Performance and Skills
Black Light--see Light (special types)
Blackout--see Motion, Effects of (acceleration and deceleration)
Blindness-see Visual (anomalies and individual differences)
Blindness, Flash--see Flash
Blinking--see Motor Performance and Skills (involuntary reflexes)
Blinking Signal Lights--see Flash (rate); Traffic (signs and signals); Warning and Signal
                        Lights
Blink Rate--see Flash; Motor Performance and Skills (involuntary reflexes)
Body
     armor--see Clothing
     build--see Anthropometric Measures
     density--see Anthropometric Measures
     movement, perception of--see Perception
     size and dimensions--see Anthropometric Measures
     supports--see Belts, Harnesses, and other Restraining Devices
     temperature--see Physiological Capacities and Indices
Bone Conduction--see Audition (physiological mechanisms)
Books in Human Factors Engineering--see General and Comprehensive References in Human
                                    Factors Engineering
Boredom--see Individual Factors Affecting Performance (motivation and morale)
Braille Systems -- see Tactile Coding
Breathing Capacity--see Physiological Capacities and Indices
Breathing Devices and Equipment--see also Masks; Underwater
Brightness
     comfort relation--see Visual (comfort and fatigue)
     discrimination -- see Visual
     sky--see Light (natural)
Broad Band Blue Illumination -- see Light (special types)
Buffeting--see Vibration (whole body)
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Cabs, Truck--see Vehicle Caffeine, Effects of -- see Drugs Caloric Intake--see Diet, Food and Nutrition

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Calorimetry--see Physiological Equipment and Methods (metabolic measurement)
Camouflage and Concealment
Canal Sickness--see Motion, Effects of (sickness)
Cardio-vascular Indices--see Physiological Capacities and Indices
Cards, Design of (e.g., data processing cards, E-Z Sort, etc.)
Cargo Handling Systems--see Supply Systems
Carrier Approach Light Systems -- see Aircraft (landing and landing systems); Lighting
                                Systems (outdoors)
Carriers--see Packs and Carriers
Cathode-Ray-Tube Displays--see Radar and other CRT Displays
Centers of Gravity--see Anthropometric Measures
Centrifuge--see Motion, Effects of (equipment and methods)
Channel Capacity--see Auditory (signals); Sensory (comparison); Visual (information processing)
Characters and Symbols, Design of -- see Numerals, Letters, and Characters, Design of
Charts, Design of -- see Maps and Charts, Design of
Check Lists--see Job Performance Aids
Chest Measurement--see Anthropometric Measures (body size and dimensions)
Choice Behavior--see Individual Factors Affecting Performance (thought processes)
Chopping--see Speech (distortion)
Chronophotography--see Motor Performance and Skills (equipment and methods)
Cinematography--see Films; Training Aids and Devices
Click-Pitch Threshold--see Audition (stimulus characteristics); Auditory (signals)
Climatic Chamber--see Environmental Conditions and Effects (equipment and methods)
Clipping--see Speech (distortion)
Closed Ecological Systems--see Space Flight Systems (sealed cabins)
Clothing
     Arctic ensembles and cold weather
     belts and fasteners
     body armor
     equipment and methods
     fabrics
     flight
     footgear
     general
     handgear
     headgear
     high altitude and anti-g
     noxious agents, protection (e.g., rocket fuel, liquid oxygen, etc.)
     radiation protection
     restrictive effects
     sizing, techniques of measurement
     space suits
     tests of--see equipment and methods, above
     thermal protection
    tropical ensembles
     underwater ensembles--see Underwater
Cochlear Response--see Audition (physiological mechanisms)
Cockpit Lighting--see Work Place Design (illumination)
Cockpits--see Aircraft (design)
Coding
    auditory signals--see Auditory (signals)
    color--see Color
    controls--see Controls
    kinesthetic--see Kinesthesis
    lights--see Light
     tactile--see Tactile Coding
    visual--see Visual
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Cognitive Processes--see Individual Factors Affecting Performance (thought processes)
Cold Environments--see Environmental Conditions and Effects
Cold Weather Protective Clothing--see Clothing (Arctic ensembles and cold weather)
Collision, Mid-Air--see Safety
Color--see also Vision (color vision)
     coding--see also Light
     filters--see Optical Aids; Vision (equipment and methods)
     lights--see Light
     paints and finishes--see Paints, Finishes, and Surfaces
     phenomena -- see Vision (color vision)
     preference--see Vision (color vision)
     smokes--see Signaling Systems, Visual
     systems (e.g., abridged systems, international XYZ system, etc.)--see Visual
              (standards and specifications)
Colorimetry--see Vision (equipment and methods)
Combat Information Centers, CIC--see Command and Control Systems
Combination Tones -- see Audition (stimulus mixtures)
Comfort--see also Seats and Seating; Visual (comfort and fatigue)
Command and Control Systems
Communication and information Theory
     general
     information assessment and processing
     redundancy, uncertainty
Communication Systems
    general
    group--see Groups
     nonverbal -- see Auditory (displays, nonverbal); Tactile Coding
     speech--see Speech
     techniques for evaluation
Comparison of Sensory Channels--see Sensory (comparisons)
Compatibility, Stimulus-Response--see Control-Display Dynamics; Sensory (general)
Compensatory Tracking--see Tracking
Complexity of Work or Task--see Work and Task Performance
Complex Tones--see Audition (stimulus mixtures)
Compression and Expansion, Speech--see Speech (distortion)
Computers
     data processing systems
     design
    general
    man interaction
     models and programs
     simulation--see also Simulation and Simulators
     systems component
Concept Formation--see Individual Factors Affecting Performance (thought processes);
                  Training (basic learning data)
Confinement -- see Prolonged Confinement
Console Design--see Panel and Console Design
Contact Analog Displays--see Displays (type)
Containers and Packaging
Contaminated Environments--see Environmental Conditions and Effects
Control-Display Dynamics
     compatibility and motion stereotypes
     feedback--see Tracking
     general
     integration
     movement ratios
     quickening--see also Tracking
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Controller, Human--see Human
Controls
     adjustments--see setting, precision, below
     aided--see Tracking
     aircraft
     automatic
     backlash, deadspace, and response lag
     combined (e.g., pushbutton on stick, ganged controls)
     comparison of types
     eye (as control mechanism)
     force and time to activate
     general
     handgrips and handles
     industrial (e.g., on machinery or equipment)
     labeling--see Labels, Design of
     linear movement
          levers and sticks
          pedals and rudder bars
          push buttons and toggle switches
     loading--see resistance, below
     location and positioning
     multiple-axis
     remote handling
     resistance (damping, inertia, friction, torque, etc.)
     rotary movement
          cranks and wheels
          knobs
     sensitivity and amplification--see Control-Display Dynamics (movement ratios)
     setting, precision
     ship and submarine controls--see Ship and Submarine
     spacecraft--see Space Flight Systems
     three-axis--see multiple-axis, above
     vehicle controls (e.g., automobiles, tanks, etc.) -- see Vehicle
Control Tower
     design of workspace--see Air Traffic Control Systems
     language -- see Language Design
     speech--see Speech (communication systems)
     systems--see Air Traffic Control Systems
Convergence (of eyes) -- see Visual (accommodation and convergence)
Correlation Techniques--see Mathematical and Statistical Methods
Cost Effectiveness Analysis--see Systems Design (techniques of analysis)
Counters--see Displays (type)
Crane Cabs--see Controls (industrial); Industrial (equipment, design of)
Cranking Movement--see Motor Performance & Skills (repetitive movements)
Cranks--see Controls (rotary movement)
Crash Impact and Survival -- see Safety
Creativity--see Individual Factors Affecting Performance (thought processes)
Crews--see Groups
Critical
     band analysis--see Ambient Noise (measurement); Speech (basic characteristics)
     flicker frequency--see Flicker
     incident technique--see Methods and Techniques for Study and Analysis of Tasks,
                         Operations, and Systems
Cross Modality Matching--see Psychophysics (methods); Sensory (interaction)
CRT Displays -- see Radar and other CRT Displays
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Cushions--see Seats and Seating
Cutaneous Communication Systems -- see Tactile Coding
Cutaneous Sense--see Touch
Cybernetics
                                             D
Damping--see Ambient Noise (reduction and control); Controls (resistance)
Dark Adaptation--see Visual (adaptation, pre-adaptation, and pre-exposure)
Data
     analysis--see Mathematical and Statistical Methods
     processing systems -- see Computers
Daylight--see Light (natural)
Dazzle--see Flash (blindness); Visual (comfort and fatique)
Deafness--see Ambient Noise (hearing loss)
Deceleration--see Motion, Effects of (acceleration and deceleration)
Decision Analysis--see Game and Decision Theory; Methods and Techniques for Study and
                   Analysis of Tasks, Operations, and Systems
Decision Making--see Command and Control Systems; Individual Factors Affecting Performance
                 (thought processes)
Decision Theory--see Game and Decision Theory
Decompression Sickness--see Environmental Conditions and Effects (decompression)
Depth Perception--see Visual (perception)
Desert--see Clothing; Environmental Conditions and Effects (hot)
Detection, Auditory-see Auditory (skills)
Detection Theory--see also Psychophysics
Detection, Visual -- see Visual (search and detection)
Dial and Scale Design--see Displays
Dial Setting--see Motor Performance and Skills (positioning movements)
Diet, Food, and Nutrition
Difference and Summation Tones--see Audition (stimulus mixtures)
Digital Displays--see Displays (type)
Dimensions
     body--see Anthropometric Measures
     furniture--see Furniture Design
     work place--see Work Place Design
Discriminability Scaling--see Psychophysics
Disorientation--see Orientation in Space, Factors Determining
Display-Control Dynamics--see Control-Display Dynamics
Displays
     auditory--see Auditory (displays, nonverbal)
     dial and scale design
    general
    location--see Panel and Console Design
     pointer design
     quickened--see Control-Display Dynamics; Tracking
     reading and interpretation problems
    size and shape
     type
         airspeed indicators
         altimeters
         attitude indicators
         combined displays (integrated)
         comparison of types (e.g., outside-in vs. inside-out)
         heading indicators
         indicator and warning--see also Warning Devices
         integrated displays--see combined displays, above
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Cursors--see Radar and other CRT Displays (range and bearing scales and aids)

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Displays
    type (cont'd)
         large displays (for viewing by more than one person, e.g., plot boards)
         other (e.g., digital, kinalog, matrix, etc.)
          polar coordinate
          radar--see Radar and other CRT Displays
          television--see Television
Distance Perception--see Visual (perception)
Distorted Vision--see Visual (field)
Diurnal Cycles
Door Handles--see Controls
Doors and Doorways--see Work Place Design (passageways)
Doppler Displays--see Auditory (displays, nonverbal)
Driving
    analysis of
    performance and skills
     safety--see Safety
Drugs
Dummy and Mannikin Design
Dye Markers--see Signaling Systems, Visual
Dynamic Acuity--see Visual (acuity)
                                            E
Far
     damage--see Ambient Noise (hearing loss)
     defenders--see Auditory (devices)
     muffs--see Auditory (devices)
    plugs--see Auditory (devices)
    protectors--see Auditory (devices)
EEG--see Physiological Capacities and Indices; Physiological Equipment and Methods
     (electrophysiological techniques)
Ego-involvement--see Individual Factors Affecting Performance (motivation and morale)
Ejection Capsule--see also Escape from; Seats and Seating
Ejection Seats--see Escape from; Seats and Seating (ejection)
Elastic Resistance--see Controls (resistance)
Electrocardiogram--see Physiological Capacities and Indices; Physiological Equipment and
                  Methods (electrophysiological techniques)
Electroencephalogram--see Physiological Capacities and Indices; Physiological Equipment
                     and Methods (electrophysiological techniques)
Electroluminescence--see Instrument Lighting
Electromyograph--see Physiological Equipment and Methods (electrophysiological techniques)
Electronic Equipment--see Equipment (design and evaluation)
Electroretinogram--see Physiological Equipment and Methods (electrophysiological
                   techniques); Vision (physiological mechanisms)
Emergency Lights--see Warning and Signal Lights
Emotion--see Individual Factors Affecting Performance
Empty Field Myopia--see Vision (effects of unusual environments)
Energy Expenditure--see Physiological Capacities and Indices
Engine Mufflers--see Ambient Noise (reduction and control)
Engine Noise--see Ambient Noise
Entrances -- see Work Place Design (passageways)
Environmental Conditions and Effects--see also Stress
     acclimatization -- see tolerance, below
    air conditioning--see Work Place Design (atmospheric control)
    air velocity
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atmospheric pressure (high altitude)

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Environmental Conditions and Effects (cont'd)
     climatic chamber--see equipment and methods, below
     cold
     decompression
     equipment and methods
     evaporative cooling
     general
     heating
     hot (includes both desert and tropical environments)
     humidity
     ionized air
     oxygen requirements
     radiation
     space--see Space Travel
     temperature (room)
     thermal radiation
     tolerance, adaptation, acclimatization
          altitude and pressure
          cold
          heat
          weightlessness--see Space Travel; Weightlessness
     toxic environments
     ventilation
     water--see also Underwater
     windblast, airblast, windchill
Equipment
     arrangement -- see Work Place Design
     design and evaluation (includes equipment not covered elsewhere, e.g., electronic
                            equipment)
     noise--see Ambient Noise
Equipment Used in Human Factors Research
Ergonomics--see General and Comprehensive References in Human Factors Engineering
Error
     analysis -- see Mathematical and Statistical Methods
     equipment -- see also Maintenance
     human
Escape from
     aircraft and spacecraft -- see also Ejection Capsules; Seats and Seating (ejection)
     other places
     submarines--see Ship and Submarine
Exercise and Performance -- see also Physical Fitness and Performance
Exits and Entrances--see Work Place Design (passageways)
Experimental Method--see Research Techniques in Human Factors Engineering
Explosive Decompression--see Environmental Conditions and Effects (decompression)
Eye
     as Control Mechanism--see Controls
     blink--see Motor Performance and Skills (involuntary reflexes)
     fixation--see Panel and Console Design (spatial dynamics, frequency of use of
               components, and order of use); Printed Material, Legibility, and Readability
     movement
                                            F
Face Masks--see Masks
Face-to-Face Communication--see Speech (communication systems)
Facial Measurements--see Anthropometric Measures
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Facilitation of Reception--see Sensory (interaction)

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Facilities (Human Engineering)
Factor Analysis -- see Mathematical and Statistical Methods
Factory Lighting--see Work Place Design (illumination)
Fallout, Radioactive--see Environmental Conditions and Effects (radiation)
Fatique -- see Auditory (aftereffects of stimulation); Exercise and Performance; Sleep
         and Performance; Visual (comfort and fatigue); Work and Task Performance
Fear--see Individual Factors Affecting Performance (emotion)
Feedback
    delayed auditory--see Auditory (signals)
    delayed speech -- see Speech (distortion)
     sensory feedback--see Sensory (feedback)
     theory--see Cybernetics
     tracking--see Tracking (feedback)
Field of View, Work Place--see Work Place Design (visibility, field of view)
Figural Aftereffects--see Visual (aftereffects, afterimages); Kinesthesis
Films
     display use
     general, human factors--see General and Comprehensive References in Human Factors Engineering
     research, use in--see Research Techniques in Human Factors Engineering
     training--see Training Aids and Devices
Filters
     auditory--see Auditory (equipment)
     optical--see Optical Aids; Vision (equipment and methods)
Fire Fighting
    clothing--see Clothing (thermal protection)
     equipment -- see also Vehicle
Fitness, Physical--see Physical Fitness and Performance
Fixtures, Lighting--see Work Place Design (illumination)
Flares--see Lighting Systems (outdoors); Signaling Systems, Visual; Warning and Signal
Flash
    blindness
    rate
    visibility
Flesch Reading Ease Formulas--see Printed Material, Legibility, and Readability
Flexibility of Movement--see Anthropometric Measures
Flicker
Flight
     control systems--see Controls
     quidance systems
     performance and skills--see also Low Level, High Speed Flight
     simulation (includes spaceflight)
     testing
     training--see Training (specific types)
Floodlights--see Lighting Systems (outdoors)
Flow Analysis -- see Methods and Techniques for Study and Analysis of Tasks, Operations,
               and Systems; Work Place Design
Fluorescent and Luminous Materials
Flybar--see Auditory (displays, nonverbal)
Fog, Haze, Smog, and Smoke
Food--see Diet, Food, and Nutrition
Foot
     dimensions -- see Anthropometric Measures
     gear--see Clothing
Form Perception--see Visual (perception)
Free Fall--see Motion, Effects of (acceleration and deceleration)
     distortion--see Speech (distortion)
     modulators--see Auditory (equipment)
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and Systems
 Furniture Design -- see also Seats and Seating
 G Forces--see Motion, Effects of (acceleration and deceleration)
Gain--see Control-Display Dynamics (movement ratios)
Galvanic Skin Response -- see Physiological Capacities and Indices
Galvanometer--see Physiological Equipment and Methods (other methods and equipment)
Game and Decision Theory
Gases--see Environmental Conditions and Effects
Gas Masks--see Masks
General and Comprehensive References in Human Factors Engineering
     articles and reports
     bibliographies
     books
     films
     handbooks
     symposia and conferences
Glare--see Flash (blindness); Visual (comfort and fatigue)
Glasses--see Optical Aids
Gloves--see Clothing (handgear)
Goggles--see Optical Aids
Graphs and Tables, Design of
Gravitational Forces--see Motion, Effects of (acceleration and deceleration)
Gravity, Centers of -- see Anthropometric Measures
Grenades--see Weapons Systems, Design of (handheld)
Grips--see Controls
Grip Strength--see Anthropometric Measures (muscular strength)
Ground Support Equipment -- see also Space Flight Systems; Weapons Systems, Design of
Grouping of Components--see Panel and Console Design (layout)
Groups
     air crews
     communication
     evaluation
     general
     infantry squads
     interaction
     leadership
     missile crews
     morale
     performance
     research techniques
     selection
     ship and submarine crews
     size and structure
     space crews
    tank crews
    theory
     training--see Training
Gunnery Training--see Training (specific types)
Gustation--see Smell and Taste
Gust scale--see Smell and Taste
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Frictional Resistance--see Controls (resistance)

Frostbite--see Environmental Conditions and Effects (cold)

Function Analysis -- see Methods and Techniques for Study and Analysis of Tasks, Operations,

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Hand
      dimensions--see Anthropometric Measures
      grips--see Controls
      signals--see Signaling Systems, Visual
      strength--see Anthropometric Measures
      tools, design of--see Tools, Design of
      wheels--see Controls (rotary movement)
 Handbooks--see General and Comprehensive References in Human Factors Engineering
Handbooks, Manuals, Texts, Design of
 Handedness--see Motor Performance and Skills
Hand Grenades--see Weapons Systems, Design of (handheld)
Handgear -- see Clothing
Handles--see Controls
Harnesses--see Belts, Harnesses, and other Restraining Devices
Hats--see Clothing (headgear)
Headphones--see Auditory (equipment)
Head Size--see Anthropometric Measures
Hearing
     aids -- see Auditory (devices)
     conservation program--see Ambient Noise (reduction and control)
     loss--see Ambient Noise; Audition (anomalies and individual differences); Speech
           (audiometric testing)
Heart Rate--see Physiological Capacities and Indices
Heat--see Environmental Conditions and Effects
Heated Suits--see Clothing (thermal protection)
Heating--see Environmental Conditions and Effects
Heat Loss--see Physiological Capacities and Indices (temperature, body)
Helicopters
Helmets--see Clothing (headgear)
High Altitude--see Environmental Conditions and Effects (atmospheric pressure)
Highway Lighting--see Lighting Systems (outdoors)
Highway Research--see also Safety (motor vehicle and highway); Traffic
Hot Weather Clothing--see Clothing (tropical ensembles)
Hot Weather Environments--see Environmental Conditions and Effects
Houses, Dwellings, and Shelters, Design of
Hue--see Vision (color vision)
Human
     controller (general discussion of man as a control mechanism)
     error--see Error
     information processing capabilities (includes reception and transmission)
     transfer functions
Human Factors Engineering--see General and Comprehensive References in Human Factors
                           Engineering
Humidity--see Environmental Conditions and Effects
Hyperopia--see Visual (anomalies and individual differences)
Hypodynamics--see Sensory (deprivation); Weightlessness
Hypoxia--see Environmental Conditions and Effects (oxygen requirements)
ICAO Phonetic Alphabet -- see Language Design
Ideal Observer--see Detection Theory; Psychophysics (theory)
Illumination--see Instrument Lighting; Light; Lighting Systems; Vision; Visual; Work
              Place Design
Illusions, Perceptual -- see Perception (illusions)
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Image Interpretation, Photographic--see Photographs, Photography, and Photointerpretation

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Immersion Suits--see Underwater (clothing and equipment)
Impaired Hearing--see Ambient Noise (hearing loss); Audition (anomalies and individual
                  differences)
Incentives -- see Individual Factors Affecting Performance (motivation and morale)
Indicator and Warning Lights--see Displays (type); Warning and Signal Lights
Indicators and Scales--see Displays (dial and scale design)
Individual Factors Affecting Performance
    acceptability of and attitude toward equipment and tasks
    alertness
    aptitude and intelligence
    emotion
    fatigue and behavior decrement--see Work and Task Performance
    general
    motivation and morale
    personality
    set and attention
    thought processes
Industrial
    deafness--see Ambient Noise (hearing loss)
    equipment, design of
    noise--see Ambient Noise (level)
     safety--see Safety (industrial)
Industry and Business, Human Factors Oriented Studies
Inertial Resistance--see Controls (resistance)
Infantry
    squads--see Groups
     training--see Training (specific types)
Information--see also Communication Systems
    analysis--see Communication and Information Theory
    processing, human--see Human
    reception, human--see Human
     storage and retrieval systems
     theory--see Communication and Information Theory
     transmission, human--see Human
Infrared Devices--see Light (special types)
Inhibition of Reception--see Sensory (interaction)
Injuries, Analysis of -- see Safety
Input Channel, Comparison--see Sensory (comparison)
Input Channel, Interaction--see Sensory (interaction)
Instructions, Effects on Task Performance--see Individual Factors Affecting Performance (set
                                           and attention); Training (basic learning data)
Instrument Lighting--see also Light; Work Place Design (illumination)
    color and intensity of illumination
     direct lighting and floodlighting
    edge and ring
    electroluminescent
    general
    rear (transillumination)
Intelligence--see Individual Factors Affecting Performance
Intelligence Testing--see Tests and Testing
Intelligibility--see Speech
Interaural Phase Cues--see Audition (sound localization)
Intercom Systems--see Speech (communication systems)
International Language--see Language Design
Intersensory Effects--see Sensory (interaction)
Interval Scaling--see Psychophysics (scaling)
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